

136309

United States General Accounting Office

GAO

Report to the Honorable
Howard C. Nielson, House of
Representatives

July 1988

TELECOMMUNICATIONS

Actions Needed for Better Management of Public Safety Spectrum



136309

RESTRICTED—Not to be released outside the General
Accounting Office except on the basis of the specific approval
by the Office of Congressional Relations.

RELEASED

042683



United States
General Accounting Office
Washington, D.C. 20548

**Resources, Community, and
Economic Development Division**

B-226720

July 8, 1988

The Honorable Howard C. Nielson
House of Representatives

Dear Mr. Nielson:

In response to your request, this report provides information on the type of use being made of radio frequencies licensed nationwide to public safety agencies. It includes recommendations to the Chairman of the Federal Communications Commission on ways to strengthen management controls over the licensing and use of these frequencies.

As arranged with your office, unless you publicly announce its contents earlier, we plan no further distribution of this report until 7 days from the date of this letter. At that time, we will send copies to the Chairman, Federal Communications Commission; interested congressional committees and subcommittees; and individual members of the Congress, as well as other interested parties. Copies will be made available to others upon request.

A list of major contributors to this report is included in appendix III.

Sincerely yours,

A handwritten signature in cursive script that reads 'J. Dexter Peach'.

J. Dexter Peach
Assistant Comptroller General

Executive Summary

Purpose

The Federal Communications Commission (FCC) has issued over 2 million licenses for radio frequency use, including 122,000 public safety licenses for services such as police and fire activities. The radio frequency spectrum is a valuable commercial commodity that is subject to competing demands for use. Broadcasters and other communication firms have questioned whether public safety users are efficiently using their allocated frequencies.

Concerned about whether the spectrum allocated to public safety is being efficiently used, Representative Howard C. Nielson asked GAO for information on (1) the types of services licensed in all public safety spectrum bands nationwide and (2) the types of services and amount of use being made of public safety frequencies licensed in 10 large cities. GAO also reviewed FCC's eligibility requirements for the public safety radio service and evaluated FCC's management controls for ensuring efficient frequency use.

Background

The radio spectrum is the medium that makes possible wireless communications of all sorts, including television and radio broadcasting, satellite communications, and land mobile radio. Because the spectrum is a valuable natural resource and competition for it has grown in recent years, its efficient use has become increasingly important, especially in large cities where congestion has been a problem, such as Chicago, Los Angeles, and New York.

Pursuant to its basic legislative authority contained in the Communications Act of 1934, as amended, FCC is responsible for managing the radio spectrum used by the private sector and state and local governments. This includes responsibility for ensuring efficiency and promoting the safety of life and property. Although the legislative history advises FCC to give public safety a priority when allocating spectrum, the act does not define "public safety" nor specify a means for identifying priority applications.

Over the last 40 years, FCC has allocated various bands of the spectrum for public safety services. In the 1970s and 1980s, FCC's allocations have been made from the 800 megahertz (MHz) band.

Results in Brief

Thirty-eight percent of public safety licenses in all bands and 34 percent of 800 MHz radio systems in the 10 cities that GAO reviewed were intended exclusively for police and fire services—activities that have

traditionally been considered public safety services. The remaining licenses were intended, at least in part, for general government, medical, and emergency response activities (such as highway maintenance, bus transportation, and ambulance services), which FCC also categorizes as public safety services.

FCC has little information on the amount of actual use being made of 800 MHz frequencies by public safety agencies. Management controls helpful for obtaining accurate data and ensuring efficient spectrum use have not been applied. Regulatory reporting requirements that would provide such information have not been enforced. Also, FCC does not monitor radio signals, make on-site inspections, or keep waiting lists of public safety applicants in high-demand areas.

Principal Findings

Type of Use

Nationwide, of all public safety licenses, GAO found that 38 percent were intended for police and fire activities, the traditional public safety services. GAO's review of FCC 800 MHz files for 10 large cities found that 34 percent of 245 radio systems were intended exclusively for police and fire activities, and another 17 percent were intended for a mix of government activities that included police and fire services along with other general government activities. The remaining systems were intended for general government, medical, and emergency response activities only, including school bus operations, airport management, public works, hospitals, and ambulances.

Some frequency users disagree with FCC's classification of public safety services and maintain that only police and fire services, and possibly ambulance and other emergency response activities, should be eligible for public safety frequencies or should be given priority. FCC believes that its broad classification is reasonable and all eligible agencies could be called on to respond to threats to life and property. While acknowledging that criteria are needed for determining priority applications in high-demand areas, FCC holds that local authorities are most familiar with their public safety needs and, therefore, are in the best position to establish local priorities. Local authorities would know, for example, that school bus operations are an integral part of emergency evacuation plans in their area, whereas such operations may not be important in another locality.

Amount and Efficiency of Use

It is difficult to gauge the amount and efficiency of 800 MHz spectrum use in the 10 cities that GAO reviewed because of a lack of data on actual use. FCC has not been enforcing its requirement that licensees report usage information. Without this information FCC cannot measure if efficient use is being made of the 800 MHz band. GAO found that while 155 licensed radio systems in its review should have filed reports with FCC, only 40, or 26 percent, did so. Further, FCC does not verify the accuracy of the data in these reports. FCC officials told GAO that FCC would begin efforts to require that public safety licensees comply with reporting requirements.

FCC also uses its license data base and informal, ad hoc sources to assess the amount and efficiency of use in the 800 MHz spectrum. The license data base, however, reflects only intended use and not actual use, and two studies, including one by FCC's Field Operations Bureau, suggest that the license data base may not be an accurate indicator of actual use. The informal, ad hoc sources include complaints filed with FCC and special studies. GAO's review of four studies of 800 MHz use found them to be of limited usefulness because they either did not look specifically at public safety use or did not consider whether the radio systems should have been in operation at the time of the study.

According to FCC staff, in some large cities public safety users are not able to obtain 800 MHz licenses because no frequencies are available. FCC does not, however, keep waiting lists of applicants to help it assess actual demand.

Further, FCC makes very limited use of two tools—monitoring radio signals and on-site inspections—that would yield data on actual use. FCC has not employed either tool in 1987 and 1988.

FCC officials were reluctant to perform additional monitoring because of the controversy generated in interpreting data obtained and because monitoring can be costly. They also believe that FCC can generally rely on government agencies to use licensed frequencies efficiently. GAO believes that FCC's responsibility to efficiently manage spectrum use requires it to be actively involved, not merely trusting in others to use spectrum efficiently.

Recommendations

To help ensure efficient use of the 800 MHz band, GAO recommends that the Chairman, FCC, strengthen FCC's management controls by (1) enforcing compliance with FCC reporting requirements, (2) monitoring radio

signals and conducting on-site inspections, on a test basis in the larger cities, to obtain and verify data on actual use, and (3) establishing a waiting list of public safety applicants in high-demand areas.

Agency Comments

GAO discussed the factual information in the draft report with FCC officials, who generally agreed with the report's findings. However, as directed by the requester, GAO did not obtain official agency comments on a draft of this report.

Contents

Executive Summary		2
Chapter 1		8
Introduction	Spectrum Management Responsibilities	8
	Legislative Emphasis and Priority for Public Safety	11
	Objectives, Scope, and Methodology	11
Chapter 2		14
Type of Public Safety Frequency Use	Eligibility for Public Safety Radio Licenses	14
	Nationwide Public Safety Use in All Frequency Bands	15
	Public Safety Use of the 800 MHz Band in 10 Cities	17
	Public Safety Eligibility in the 800 MHz Band	19
Chapter 3		24
FCC Does Not Maintain Data for Determining Efficient Spectrum Use	Defining and Measuring Frequency Use	24
	Low Compliance With FCC Reporting Requirements	28
	Monitoring, On-Site Inspections, and Waiting Lists Not Used	28
	License Data and Informal Information Available on Public Safety Use	31
	Conclusions	35
	Recommendations	36
Appendixes	Appendix I: Summary of Four Studies of 800 MHz Frequency Use	38
	Appendix II: Request Letter From Representative Howard C. Nielson, House of Representatives	41
	Appendix III: Major Contributors to This Report	42
Tables	Table 2.1: Public Safety Licenses Issued in All Frequency Bands	16
	Table 2.2: Public Safety 800 MHz Radio Systems in 10 Cities	17
	Table 2.3: Ten Cities' Intended Use of Their 800 MHz Public Safety Radio Systems	19
	Table 2.4: Summary of Non-Police/Fire Public Safety Radio Systems in 10 Cities	19

Abbreviations

APCO	Associated Public-Safety Communications Officers, Inc.
FCC	Federal Communications Commission
FOB	Field Operations Bureau
GAO	General Accounting Office
MHz	megahertz, or one million cycles per second
NTIA	National Telecommunications and Information Administration
RCED	Resources, Community, and Economic Development Division

Introduction

The radio frequency spectrum is the medium that makes possible wireless communications of all sorts, such as land mobile radio, shortwave and commercial radio, television, microwave telephone relays, radar, radio navigation, radio astronomy, and various satellite transmission activities. As a natural resource, the radio frequency spectrum is like a river used for transportation—it cannot be used up, but it can suffer from congestion if too many people operate on it in an uncoordinated way. Therefore, the spectrum must be carefully managed, both on a national and international level, in order to best meet the needs of a constantly increasing number and variety of users.

Progress in modern electronics is making radio spectrum policy increasingly important as new, inexpensive electronics make it easier to use the spectrum and increase the range of uses. Briefly, spectrum policy consists of two basic choices: What kinds of services shall the spectrum provide? Who may use the spectrum?

The Federal Communications Commission (FCC) is responsible for managing the efficient use of the radio spectrum allocated to the private sector and state and local governments. Over the last 40 years, FCC has allocated frequencies from various parts of the radio spectrum for public safety use. In 1986 FCC decided that public safety agencies should receive frequencies totaling six megahertz (MHz) in the 800-900 MHz band of the radio spectrum.¹ These frequencies were in addition to other 800 MHz frequencies that had already been allocated for public safety. FCC has conservatively estimated the economic value for commercial purposes of the six megahertz to be on the order of several hundred million dollars. Broadcasters and other communication firms, which have been competing with public safety for radio spectrum, have questioned the need for additional public safety frequencies when they believe there is uncertainty about whether public safety services are efficiently using their existing frequencies.

Spectrum Management Responsibilities

Pursuant to its basic legislative authority contained in the Communications Act of 1934, as amended (47 U.S.C. 151 *et seq.*), FCC is responsible for managing the radio frequency spectrum used by the private sector

¹Radio waves are produced by the oscillation of electricity within a conductor, such as an antenna. The number of times per second that a radio wave undergoes a complete cycle of oscillation is called its frequency, which is measured in units called hertz. Modern equipment can produce oscillations ranging from several thousand hertz (cycles per second) to several billion hertz. The terms kilohertz (thousands of hertz), megahertz (millions of hertz), and gigahertz (billions of hertz) are used in referring to the higher frequencies.

and state and local governments. This includes responsibility for allocation, assignment, and efficient use of the radio spectrum.

Allocation

Allocation involves setting aside bands, or blocks, of frequencies for the use of particular radio services.² Over the last 40 years, as radio technology developed and public safety's communication needs increased, FCC has allocated various frequency bands for public safety radio services. Frequencies within the following radio spectrum bands have been allocated nationwide to the public safety radio services:

- the 25-50 MHz band,
- the 150-174 MHz band,
- the 450-470 MHz band,
- the 470-512 MHz band (available only in 13 large cities), and
- the 806-824 and 851-869 MHz bands (the 800 MHz band).

Public safety is not the only radio service using frequencies in the 800 MHz band. In the 806-821 and 851-866 MHz bands, certain frequencies totaling 3.5 MHz were allocated during the 1970s and early 1980s specifically to public safety while other frequencies were made available to various radio services, including public safety, on a first-come, first-served basis. In 1986 FCC made its latest allocation to public safety when it gave public safety additional frequencies in the 821-824 and 866-869 portions of the 800 MHz band. No licenses will be issued to public safety to use these new 800 MHz frequencies until FCC approves regional public safety communication plans currently under development.

Assignment

Assignment includes selecting and licensing the use of discrete frequencies within spectrum bands for the operation of individual radio systems. In January 1988 FCC had about 2.1 million licensed radio users in its data base, including about 122,000 public safety licensees. FCC reviews applications for licenses to ensure that applicants meet the requirements of the Communications Act and FCC rules.

Identifying and selecting appropriate radio frequencies for license applicants may also involve a process referred to as "frequency coordination." Frequency coordination is the process by which a private organization recommends to FCC the most appropriate frequencies for

²An official record of the current FCC allocation of the spectrum is maintained in the "Table of Frequency Allocations," Section 2.106 of the FCC Rules and Regulations.

applicants in the designated radio services. The process of identifying appropriate radio frequencies involves a variety of factors that depends on the specific needs of each applicant and the complex environmental conditions in which the radio system will be operating. Coordinators play an important role in helping FCC develop and manage radio frequencies. The frequency coordinator for the public safety radio services in the 800 MHz band is the Associated Public-Safety Communications Officers, Inc. (APCO).

Efficient Use

Efficient frequency use is sought through FCC rules and regulations that govern license requirements and operation of radio systems. These include technical standards that restrict signal strength, bandwidth, distortion in the signal, type of emission, and hours of operation. FCC also requires that license applicants provide information on technical and ownership characteristics of the proposed radio system and the purposes for which it is to be used.

Radio Service Categories

To help carry out its licensing responsibilities and to recognize that various types of radio users have different technical requirements, FCC has classified radio services into three broad categories: broadcasting, common carrier, and private radio services. Radio and television communications designed for reception by the general public are known as broadcasting. Common carriers provide radio services for hire. For example, cellular common carriers provide car telephone service to businesses and individuals who are willing to pay for this service. The private radio services are used mostly for the two-way communications of individuals, organized groups, businesses, and state and local government agencies. These services are called private because they are used for private purposes, unlike broadcasting, which serves a public audience, or common carrier services, which are similar to public utilities.

Private radio services provide communications for a wide variety of purposes in land, sea, and air transportation; law enforcement and fire prevention; commerce and agriculture; education and science; and personal travel and recreation. The private land mobile radio services, which include public safety, have about 673,000 licenses and represent the largest group of licensed radio users regulated by FCC. The expanding use of mobile communications since the 1960s has led to increased demands for, and congestion in, the private land mobile frequency bands, particularly in the nation's largest metropolitan centers.

Legislative Emphasis and Priority for Public Safety

In a 1937 amendment to the Communications Act of 1934 and in more recent legislation adopted in 1982 and 1983, the Congress has stated its intent that FCC manage radio communications to promote the safety of life and property. For example, section 1 of the Communications Act of 1934, as amended, states

“...for the purpose of promoting safety of life and property through the use of wire and radio communication...there is hereby created a commission to be known as the ‘Federal Communications Commission’...” (underscoring provided)

Besides directing FCC to promote the safety of life and property, the legislative history also advises FCC to give public safety priority in allocating spectrum. The Senate Committee Report to the Communications Amendments Act of 1982 (Senate Report No. 97-191, 97th Cong., 2d Sess., Sept. 18, 1981) states that “radio services which are necessary for the safety of life and property deserve more consideration in allocating spectrum than those services which are more in the nature of convenience or luxury.” Also, the House Committee Report to the Federal Communications Commission Authorization Act of 1983 (House Report No. 98-356, 98th Cong., 1st Sess., Sept. 15, 1983) states that the “Committee believes...that public safety consideration should be a top priority when frequency allocation decisions are made.”

While the Congress instructed FCC to promote public safety’s radio spectrum needs, it did not categorically define what is included or excluded in the term “public safety,” nor did it specify how FCC should give public safety priority in spectrum allocation decisions. FCC has defined public safety as generally including medical, rescue, and emergency response services and any official state or local government activity. As for recognizing public safety’s priority, FCC’s approach is basically a subjective process that gives “important consideration” to public safety’s spectrum needs rather than a formula that determines precisely how many more frequencies public safety receives than do other types of services.

Objectives, Scope, and Methodology

In a June 10, 1987, letter Representative Howard C. Nielson requested that we study the existing use of radio frequencies for public safety purposes to determine if efficient spectrum use is occurring. Following discussions with the Congressman’s office, we agreed to (1) provide summary statistics compiled by FCC on the type of use being made of all radio frequencies licensed nationwide to public safety agencies and (2) obtain information from FCC and APCO records on the type and amount of use being made by public safety agencies in the 800 MHz band

in 10 large cities. In addition to collecting information on public safety frequency use, we reviewed FCC's eligibility criteria for the public safety radio service and evaluated the adequacy of FCC's management controls for ensuring efficient frequency use by public safety licensees in the 800 MHz band.

We obtained nationwide summary statistics on public safety use in all spectrum bands from FCC's master frequency license file. The master frequency file is a computerized data base of technical and administrative information relating to FCC license authorizations.

To obtain more detailed information on frequency use in the 800 MHz spectrum band, we also examined paper license files on public safety radio systems licensed in 10 large cities. (The paper license files contain more information than is available in the master frequency file. Paper files contain various documents such as the application form, the license, frequency coordination forms, and related correspondence.) FCC staff provided us a master frequency file listing of public safety radio systems licensed as of October 1987 for operation within 100 miles of the 10 cities' geographic centers. (FCC staff often use a 70-mile interference radius when analyzing 800 MHz licenses. As suggested by an FCC engineer, we used a 100-mile radius as a conservative criterion.) Of 283 public safety radio systems identified from the master frequency file, FCC was able to readily provide us with 246 paper files. We did not ask FCC to initiate a search for the other 37 files because of the cost and time involved. Further, information in these files would not have affected our overall findings.

The 10 cities in our review were Baltimore, Chicago, Denver, Miami, New York, Philadelphia, Phoenix, Seattle, St. Louis, and Washington, D.C. These cities were among 21 metropolitan areas identified by FCC as having relatively high concentrations of public safety radio systems. The cities offer a cross section of major urban areas in terms of location, size, and prospects for growth. The 10 cities have received 30 percent of all public safety 800 MHz licenses issued by FCC. Since FCC considers each city unique in its private land mobile frequency use, results obtained from the 10 cities cannot be statistically projected nationwide.

We interviewed officials from FCC's Office of Engineering and Technology, Private Radio Bureau, and Field Operations Bureau; representatives from FCC's Commissioners' offices; the APCO executive director; and representatives from various industry and trade groups interested in public safety spectrum use. We also reviewed various studies related to

public safety spectrum use prepared by FCC staff or filed in FCC proceedings.

Our audit work was conducted primarily at FCC's headquarters in Washington, D.C., and its licensing facility in Gettysburg, Pennsylvania, between September 1987 and March 1988. We performed our work in accordance with generally accepted government auditing standards. As directed by the requester, we did not obtain official agency comments on a draft of this report. However, we discussed the factual information in the report with FCC officials and APCO's executive director during the course of our work and have incorporated their views as appropriate.

Type of Public Safety Frequency Use

FCC eligibility requirements for obtaining a public safety radio license specify that the intended use must be for public safety, generally defined as including medical, rescue, and emergency response services and any official state and local government activity.

Nationwide summary statistics on public safety use in all spectrum bands show that about 38 percent of public safety licenses were intended specifically for police or fire use—activities that have traditionally been considered as public safety. Data obtained from FCC's 800 MHz license files for the 10 cities selected for our study, although not directly comparable to the summary statistics for all bands, showed that 51 percent of the public safety radio systems were intended to be used to some degree for police and fire activities. The other 49 percent were intended to support general government, medical, and emergency response services, such as ambulance companies, highway maintenance, and school and municipal bus transportation.

Some radio spectrum users believe FCC's eligibility requirements for obtaining a public safety license are too broad. They would exclude, for example, general government services that may not usually involve responsibility for protecting life and property. However, FCC officials and APCO's executive director pointed out that many general government activities, depending on the situation and the region of the country, can involve the safety of life and property. Examples include using highway maintenance trucks to clear snow-covered streets and using school buses to evacuate citizens during a hurricane warning. FCC believes local authorities are in the best position to define their most important public safety communication needs.

Eligibility for Public Safety Radio Licenses

FCC's eligibility requirements broadly define public safety as including medical, rescue, and emergency response services and any official state and local government activity. Entities engaged in these activities are eligible to receive a public safety radio license from FCC. FCC considers all of these activities and services as having some involvement with public safety, although the entities' degree of involvement and their public safety roles and responsibilities vary from one region to another. FCC grants licenses for available frequencies to eligible public safety agencies on a first-come, first-served basis.

Specifically, FCC's rules¹ include the following public safety categories:

Public safety radio services

police
fire
local government
highway maintenance
forestry-conservation

Special emergency radio service

medical services (hospitals, clinics, ambulance companies, and physicians)
rescue organizations
physically handicapped
veterinarians
disaster relief organizations
school buses
beach patrols
persons or organizations in isolated areas
utility emergency standby and repair facilities

Nationwide Public Safety Use in All Frequency Bands

As of January 1988, FCC had issued 121,588 public safety radio licenses nationwide in all frequency bands, of which 1,845 were in the 800 MHz band. Table 2.1, prepared with information from FCC's computerized license data base, provides summary statistics on the type of use intended for all radio frequencies licensed nationwide to public safety agencies.

¹FCC's rules governing the conditions under which public safety radio communications systems may be licensed and used are found in the Code of Federal Regulations, Title 47, Part 90, Private Land Mobile Radio Services.

Table 2.1: Public Safety Licenses Issued in All Frequency Bands

Category	Licenses	Percent of total
Licenses not in 800 MHz band		
Police	25,046	21
Fire	21,343	17
Local government	33,835	28
Highway maintenance	8,931	7
Forestry conservation	7,481	6
Special emergency	23,107	19
Total not in 800 MHz band	119,743	98
Licenses in 800 MHz band		
Public safety/special emergency	1,845	2
Total public safety radio licenses	121,588	100

As shown in the table, the traditional public safety agencies (police and fire) account for a large percentage of the licenses, but other general government, medical, and emergency response users also account for a significant percentage. Thirty-eight percent of all public safety licenses have been specifically assigned to police and fire services. The percentage of police and fire licenses could be higher if the nature of use by licensees in the local government category and in the 800 MHz band could be determined. However, a more detailed breakdown is not possible on the basis of the information in the data base. FCC staff in the Private Radio Bureau explained that some of the licenses in the local government category are also used for police and fire activities. (For example, one government agency may hold all licenses for the municipality in its name.) Also, although FCC licenses each public safety user according to the specific category of licensee (for example, police, fire, local government, or special emergency service) in frequency bands below 800 MHz, public safety users in the 800 MHz band are licensed only under the broad public safety/special emergency category. However, if data on specific categories were available for the 800 MHz band, the percentages shown in table 2.1 for police and fire would probably not change by more than a percentage point or two because of the small number of 800 MHz public safety licenses relative to the total for all bands.

Public Safety Use of the 800 MHz Band in 10 Cities

Data we developed on use in the 800 MHz band show that about 51 percent of the public safety radio systems were intended to some degree for traditional police and fire public safety activities and 49 percent for general government, medical, and emergency response purposes.

We reviewed the available FCC files for 800 MHz public safety licensees in 10 large cities to determine what information was available on the type of use intended for the assigned frequencies. (The license files indicate only the type of use intended for licensed frequencies. After granting the license, FCC does not verify that the frequencies are actually used for the purposes described on the application or license.) The 10 cities included in our study had 554 of the total 1,845 public safety licenses (30 percent) that FCC has issued nationwide in the 800 MHz band. Table 2.2 lists the 10 cities and shows the number of licenses and radio systems.

Table 2.2: Public Safety 800 MHz Radio Systems in 10 Cities

City	Licenses	Radio systems	Radio system files reviewed ^a
Baltimore/Washington ^b	65	36	36
Chicago	208	68	51
Denver	18	17	16
Miami	68	57	55
New York/Philadelphia ^b	152	63	50
Phoenix	18	17	15
Seattle	14	14	13
St. Louis	11	11	10
Total	554	283	246

^aFCC could not readily provide us with 37 of the radio system files. Because the information from these files would not have affected our overall findings and because of the cost and time involved, we did not ask FCC to conduct an extensive search for these files.

^bBecause of our 100-mile selection criterion and the proximity of these cities to each other, many of the same licenses were listed for both cities. Consequently, to facilitate our analysis, we combined the cities and eliminated duplicate licenses.

Some individual public safety radio systems were issued more than one license. For example, a state highway department might be issued numerous licenses for a radio system supporting the communication requirements of a statewide toll highway—one license for each fixed transmitter. To present a more accurate picture of public safety use, we grouped these multilicensed radio systems together and counted them as single systems. As a result, the data shown in table 2.2, which is based

on radio systems, are not directly comparable to the summary statistics presented in table 2.1, which is based on licenses.

As noted earlier, FCC's public safety license files contain limited data on the type of use being made by a radio system. The files do provide some general descriptive information on how a licensee intends to use a radio system. A typical file contains a brief eligibility description of the license, technical data about the license itself, and relevant correspondence. No information is included in the files on the amount of emergency use planned for the licensed radio system. Despite the limited data contained in the files, for the purposes of our review, we were able to group the intended use of the radio systems into three categories: (1) systems used exclusively for police and fire activities, (2) systems used to some degree for police and fire activities, and (3) systems used for other general government, medical, and emergency response activities.

Our review of 246 licensed public safety radio systems in the 10 cities found that 245 of the systems were eligible under FCC's public safety criteria. One system, licensed to a trucking firm in the New York/Philadelphia area, appeared to be ineligible. According to the chief of FCC's Licensing Division, this system had been incorrectly coded as a public safety license. He said that sometime after October 1987 it had been correctly reclassified as an industrial/land transportation radio system.

As table 2.3 shows, we found that 126 of the 245 public safety radio systems (51 percent) were intended to be used exclusively or in part for police or fire activities. Of these, 84 radio systems were to be used exclusively to support police and fire services. The other 42 radio systems were multi-agency systems that included, but were not limited to, police and fire activities. The remaining 119 radio systems, described in more detail in table 2.4, were licensed to support a wide range of government and medical activities, including ambulances, bus service, highway maintenance, airport management, public works, and school bus transportation.

Table 2.3: Ten Cities' Intended Use of Their 800 MHz Public Safety Radio Systems

City	Radio systems	Exclusively police and fire	Mixed systems—including police and fire	Other
Baltimore/Washington	36	12	10	14
Chicago	51	21	4	26
Denver	16	5	1	10
Miami	55	15	16	24
New York/Philadelphia	49	16	5	28
Phoenix	15	8	3	4
Seattle	13	4	1	8
St. Louis	10	3	2	5
Total	245	84	42	119
Percent	100	34	17	49

Table 2.4: Summary of Non-Police/Fire Public Safety Radio Systems in 10 Cities

Type of use	Number of radio systems
Ambulance, hospital, and other medical services	12
Bus service	6
Criminal justice and corrections	6
Highway, airport, and other transportation services	16
Local government service—Identified ^a	20
Local government service—Unidentified ^b	27
Public works and utilities	19
School bus transportation and maintenance	13
Total	119

^aLocal government services described in the license files include such activities as (1) pest control and management, (2) college campus security, (3) mayor's communication system, (4) public housing, (5) mental health, and (6) municipal vehicle dispatch.

^bInformation in license files did not indicate the type of local government use.

Public Safety Eligibility in the 800 MHz Band

Some radio spectrum users believe that FCC's eligibility requirements for obtaining a public safety license are too broad. In our discussions with FCC staff, public safety officials, representatives from radio services competing with public safety, and others, there was general agreement that a policy that gives public safety services priority in obtaining needed frequencies is reasonable. Differences arose, however, about

which particular services deserve to be included in a public safety classification and about which are more critical to protecting life and property.

Concerns With FCC's Public Safety Classification

The parties that objected to FCC's broad definition of public safety tended to relate "true" public safety with an emergency response role and the traditional public safety agencies. A 1986 Mobile Satellite Corporation study stated, for example, that many public safety licensees in the 800 MHz band were using frequencies for purposes that do not provide the kind of life-saving services that can logically justify any special claim to a public safety frequency allocation. As examples of non-public-safety functions, the study cited radio systems operated by the Meadowlands Sports Complex for traffic control and operations, Transport of New Jersey for dispatching its buses, and the Illinois State Toll Highway Authority for toll collection and highway maintenance. Mobile Satellite concluded that although these functions are eligible for public safety frequencies under current FCC rules, it is inappropriate to argue that their communications needs should have a priority.

Communications officers from two large police departments told us that, when FCC licenses frequencies, the individual services within FCC's broad public safety category should be prioritized, at least in congested urban areas where radio spectrum is scarce. According to one official, even though a highway maintenance service may be considered a "seasonal" emergency service, police or fire departments are operating on a continual basis. This officer suggested that a higher priority be given to police, fire, and ambulance services that operate on a continual emergency basis. The other official suggested a breakout of public safety services into three levels of priority: (1) police, fire, and emergency medical services, (2) agencies that respond to emergencies on a seasonal or irregular basis, and (3) agencies that would rarely respond to emergencies.

FCC's Rationale for Its Public Safety Definition

FCC staff in the Private Radio Bureau (the unit responsible for licensing frequencies to public safety agencies) and the Office of Engineering and Technology (the unit responsible for advising FCC's Commissioners on public safety spectrum allocations) maintain that the present public safety classification is reasonable. They believe that all services in FCC's public safety classification may need to respond to emergencies involving the safety of life and property. They point to the difficulty of establishing a more narrow classification that would fit public safety use in all areas of the country; consequently, FCC leaves it to local authorities

to decide what activities are most important to the safety of life and property. They also note that trunking, a modern technology used in the 800 MHz band, reduces the need for a more restrictive public safety classification because it encourages several agencies with varying public safety requirements to use the same radio system. (See the following section for more detailed information on trunking.) The technology itself, through its computerized design features, automatically determines the most critical public safety communications. Therefore, according to FCC staff, there is less need for a narrow classification of public safety.

FCC has recognized that in some areas there may not be enough frequencies for all eligible applicants and, therefore, criteria are needed for determining which applicants should have the highest priority. FCC has decided that regional public safety planning committees are in the best position to determine which public safety activities are more critical to protecting life and property. In its Report and Order, adopted November 24, 1987 (Docket No. 87-112), FCC established policies and rules governing use of the new 800 MHz frequencies allocated to public safety. In that Report and Order, FCC stated

“The Public Safety Radio Services and the Special Emergency Radio Service are both involved with public safety. There are, however, many types of eligible entities within each of these two broad service categories. The various eligible entities within these categories have different roles and responsibilities in public safety that vary from one region to the next. For example, school buses . . . are included in emergency evacuation plans in some areas and not in others. Similarly, the Forestry-Conservation Radio Service . . . may have a limited role in public safety in metropolitan areas like New York City. Since both the Public Safety Radio Services and the SERS play important roles in public safety in many areas, we continue to believe it necessary to make both services eligible to operate [on the new frequencies]. We recognize, however, that in some regions it may not be possible to grant requests for assignments in the new 800 MHz spectrum to everyone who is eligible. In such cases, the highest priority must be given to those organizations most fundamentally involved in protection of life and property. We believe that regional planning committees are in the best position to determine which services are of the greatest importance to public safety in their regions. . . .”

FCC staff and APCO's executive director provided numerous examples of government entities that are not normally engaged in daily emergency operations but must still respond to emergencies and therefore could be considered as serving a public safety function. Examples include

- a highway department responding to a heavy snow storm by plowing the streets,

- school buses being used to evacuate citizens in a declared emergency,
- a state forestry service responding to a major forest fire spreading throughout the state,
- a public works department responding to flooding, and
- building inspectors responding to a building collapse.

Further, if the public safety classification were based on the amount of emergency use, another problem of definition might arise. The difficulty of defining “emergency” radio communications is discussed in a 1985 report on public safety telecommunications requirements by FCC’s Private Radio Bureau. In preparing the report FCC requested comments from interested parties on, among other things, what portion of public safety communications are for emergency and nonemergency purposes. The report noted that a relatively wide range of estimates was received in response to this question, apparently as a result from varying interpretations of which communications are “emergency-related.” As stated by the Washington State Patrol,

“It is difficult to define what portion of our traffic is emergency. We feel that traffic such as status and computer inquiries are emergency as it is basic to the job we do which is emergency by its nature. Emergencies could not be handled if we did not know who was in-service and their location; and if we do not provide all the proper tools to the officer in the field. We can not respond to emergencies if we are not prepared. A fire engine in the fire house is just as important as one at the scene of a fire. With this definition, we find over 90% of our traffic to be emergency in nature and about 10% is of an administrative nature.”

Trunking Technology Allows Multi-Agency Use of Assigned Radio Frequencies

According to FCC staff and APCO’s executive director, trunking technology reduces the necessity to determine the most important public safety activities. Trunking technology enables various governmental agencies with different demands and levels of priority to use the same system.²

Trunking can be defined as an automatic method of temporarily assigning radio communication channels³ to users from a central pool of channels. In trunked systems, from 5 to 20 channels are pooled together so that each mobile unit of the system can be automatically given access to any of the channels not then in use. Trunking has certain advantages

²Trunking can also be used by a single public safety agency. A large metropolitan police department may find that using a five-channel trunked system is an effective and efficient way for it to meet its communication requirements.

³In the 800 MHz band, a typical radio channel between a mobile unit and the dispatch center uses two frequencies—one frequency is used by the mobile unit and another frequency is used by the dispatch center.

over the conventional channel design. When a conventional channel is in use, the caller must wait until the channel is free or search manually for a free channel, whereas a trunked system automatically scans a number of channels and assigns a vacant one when needed. The trunked system is often more spectrum-efficient, permitting idle channels to be assigned on an as-needed basis to users, thereby increasing the utilization of the radio channels. This means that fewer channels are required to satisfy the communications needs for a greater number of users. With a multi-agency trunked radio system, for example, general government agencies may make heavy use of the system during weekday afternoons when police and fire services have relatively light use, while police and fire services may make heavy use of the system at night and during the weekend when general government agencies are not open.

Trunking's computer-based design features allow a caller, whether a police officer or public works official, to obtain access to a channel when emergency-related communications are necessary. In other words, trunking technology automatically sets priorities for the different users on the system. For example, a multi-agency trunked system might normally assign priority to police and fire operations, but in the case of flooding the public works department may be allowed a priority equal to police and fire operations.

FCC encourages use of trunking technology in the 800 MHz band for larger radio systems. Some frequencies have been specifically set aside for trunked systems, and in the new 800 MHz allocation made in 1986 to public safety, FCC requires trunking for radio systems with more than four channels. We noted that 22 of the 42 multi-agency systems shown in table 2.3 were licensed to use trunking technology.

FCC Does Not Maintain Data for Determining Efficient Spectrum Use

FCC does not routinely collect sufficient information on public safety agencies' use of 800 MHz frequencies to determine how efficiently these frequencies are being used. We found that FCC has some reporting requirements for gathering data from public safety agencies on the number of vehicles and portable radios operating on the licensed frequencies. However, our review of license files for 155 radio systems with a report due disclosed that only 26 percent of the files included any of the required reports. Also, reports that were received by FCC were not checked to verify that the data reported accurately reflected actual frequency use. FCC officials told us that limited resources and other higher priority work have kept them from following up with public safety agencies that have not filed the required reports.

For information on spectrum use, FCC relies heavily on its data base of authorized licenses and on "informal" means such as special studies and complaints made by groups competing for public safety frequencies. While these sources may provide helpful information to FCC, they furnish only minimal data on the amount of actual use being made of 800 MHz frequencies. FCC does not use other management tools such as monitoring radio signals and making on-site inspections to check on public safety agencies' use of their assigned spectrum. Nor does FCC maintain a list of public safety agencies that want 800 MHz frequencies but cannot obtain them because frequencies are not available. APCO, a volunteer organization that is the frequency coordinator for public safety, does not collect data on actual frequency use. Consequently, FCC does not know whether public safety agencies are efficiently using the 800 MHz frequency band.

Defining and Measuring Frequency Use

Generally accepted criteria for measuring the amount of public safety frequency use or evaluating whether a given level of use is efficient have not been established by FCC. However, FCC has established regulatory criteria governing radio use in the 800 MHz band and has also established licensee reporting requirements for determining efficient frequency use.

No Generally Accepted Criteria

FCC has recognized that the issue of measuring use and assuring that licensees are efficiently and effectively using authorized radio frequencies is one of the most difficult and recurring questions it has faced in regulating use of the 800 MHz band. In a Memorandum Opinion and Order adopted on October 19, 1983, in Docket No. 79-191, FCC said that while no one disputed the need for some established measure of efficient

and effective spectrum use, there was little or no agreement on what constitutes such use. For example, FCC noted that the amount of time when a frequency is occupied by a signal (referred to as air time) had been suggested as a criterion for measuring frequency use. Under this criterion, a frequency is efficiently and effectively used when it is occupied by a signal a large percentage of the time. However, as FCC pointed out, using air time as a measure of efficient spectrum use requires, as a prerequisite, the development of standards for computing what measure(s) of air time would constitute "efficient use." FCC stated that advocates of this approach had not provided it with any serious discussion of what these standards should be, how they might be developed, and whether standards should be uniform or developed for each service.

Reaching agreement on criteria for public safety frequency use has been especially difficult. As a general proposition, public safety users maintain that a channel is efficiently and effectively used when it is immediately available when an emergency arises. They point out that public safety systems are necessarily designed to account for this need. They also note that it is not uncommon in public safety systems to have channels employed for activities, such as undercover surveillance, during which air time occupancy could be relatively light even though the channel is being used.

In an earlier report, The Los Angeles County Sheriff's Request for Radio Frequencies (GAO/RCED-84-158, Aug. 23, 1984), we discussed the difficulties encountered by several agencies in measuring efficient public safety spectrum use. We identified various "rules-of-thumb" used by communications officials at agencies that we visited to measure and judge efficient use. One official said that the rule for a dispatch channel was that if it was in use over 30 minutes an hour, it was considered to be saturated. Another thought that a frequency in use over 18 minutes in an hour was overloaded. The waiting time for a radio user to gain access to an available frequency was an important factor mentioned by several users and FCC staff. They said that waiting time depended on the average message time and the total time a frequency was in use. Nevertheless, we found no generally accepted criteria on what is adequate waiting time for public safety agencies.

According to officials from the Los Angeles County Sheriff's Department, they use a criterion that a channel in use 20 minutes in an hour is an indicator of a loaded channel. They have also determined that a patrol officer should not have to wait longer than 5 seconds to use a

channel. Another criterion they mentioned was that if 30 cars were assigned to one channel, they considered the channel to be fully loaded.

FCC's Use Criteria in the 800 MHz Band

After addressing the issue of frequency use in several decisions during the 1970s and 1980s, FCC concluded that although various criteria had been suggested, no proposals as to specific measures of efficient frequency use had been offered. Recognizing that some standard of use was necessary to ensure spectrum efficiency, FCC established its own regulatory criteria in the 800 MHz band by requiring that licensed channels be "loaded" with a minimum number of mobile units (that is, vehicles, portable radios, and control stations). Another FCC regulation related to frequency use requires that a licensed radio system be constructed and the frequencies placed in operation within 8 months to 1 year, depending on the type of radio system.¹

Mobile Loading Criteria

Once an 800 MHz radio system is in operation, FCC rules dictate that an efficiency standard of a certain number of mobile units (vehicles, portable radios, and control stations) be met for the licensee to maintain the frequencies. These mobile loading criteria assume that each mobile unit operating on a radio system generates a set amount of traffic. According to FCC staff, counting the number of mobile units operating on a channel is a reasonable representation of frequency use. FCC believes that its mobile loading standards are a valid measure of efficient spectrum use, besides being relatively easy to administer.

Since FCC first allocated land mobile 800 MHz frequencies in the 1970s, it has revised its mobile loading standards several times. Generally, between 50 and 100 mobile units have been required per channel, depending on the particular radio service, the geographic area, and whether the radio system was conventional or trunked. FCC's latest revision, made in February 1988, established a standard of 70 mobile units per channel for all land mobile services and radio systems using 800 MHz frequencies.

Construction Time Limit

In order to ensure that limited frequencies in the 800 MHz band are used and are not idle when others could use them, FCC rules require that

¹Radio users will normally wait until they have received an authorized license before beginning to buy equipment and build their radio system.

licensed radio systems be constructed and frequencies placed in operation within 8 months of the license issue date for conventional systems and within 1 year for trunked systems. Otherwise, the license cancels automatically and must be returned to FCC. Under certain circumstances FCC allows public safety agencies to take up to 3 years to place a radio system in operation. These are referred to as "slow growth" systems.²

Reporting Requirements

To check compliance with these regulatory requirements, FCC rules require that private land mobile licensees in the 800 MHz band file reports on system construction and the number of mobile units operating. These reports, although furnishing limited information, provide FCC with a management control mechanism to help assure that licensees are making some use of licensed frequencies and are operating with a minimum number of mobile units.³

Within 9 months of the date of the grant of their license, licensees of conventional systems must file a report on the number of mobile units placed in operation. Subsequent reports are not required. Within 13 months of the date of their license and annually thereafter, licensees of trunked systems must report the number of mobile units being served and whether construction of the facility has been completed.

Slow growth systems have special reporting requirements. In its Second Report and Order, Docket No. 79-191, adopted July 22, 1982, FCC recognized that since slow growth systems tie up channels to the disadvantage of other applicants, these applicants need to demonstrate that they are constructing their systems in a diligent and expeditious fashion in compliance with an implementation schedule. Therefore, FCC required that licensees of slow growth systems file annual implementation reports describing the extent to which the authorized system has been implemented. FCC also cautioned that slow growth authorization is conditional upon a licensee's compliance with the implementation schedule. FCC stated in its order that "if a licensee fails to meet that schedule, its authorization for the frequency(s) involved will be void."

²One of the requirements for a public safety slow growth system is that the local governmental agency demonstrates that it is required by law to follow a multiyear cycle for planning, approving, funding, and purchasing the proposed system.

³Internal controls that federal agencies are required to follow are set forth in GAO's Standards for Internal Controls in the Federal Government published in 1983 pursuant to the Federal Manager's Financial Integrity Act of 1982.

Low Compliance With FCC Reporting Requirements

We reviewed FCC's license files for the 245 public safety radio systems for the 10 cities included in our study and found that 155 radio systems should have filed a report with FCC on the status of system construction and mobile loading. (Twenty-six radio systems were recently licensed and did not have a report due at the time of our review. Another 64 did not operate their own radio system; rather, they used the services of commercial firms called specialized mobile radio systems. Public safety licensees using specialized mobile radio systems do not have to file a report with FCC.) We found that 40 files, or 26 percent of the 155 systems, included a report. Additionally, most of these reports provided limited information on current use: 13 were dated prior to 1985, and another 18 reports from slow growth licensees said that their systems were not yet operating. Also, in spite of the importance FCC has placed on slow growth systems complying with their implementation schedules, the files of only 25 of 61 slow growth systems with an annual implementation report due included such a report. Finally, when reports are received from public safety licensees, FCC has no process to verify that their information accurately reflects actual frequency use.

The Chief of FCC's Private Radio Bureau, the organizational unit responsible for licensing public safety agencies, told us that the licensees' failure to submit the reports was probably not intentional, but rather an oversight. He also explained that, because FCC resources are limited, public safety licensees' compliance with FCC reporting requirements has not been a Bureau priority. For about the last 6 years, the Private Radio Bureau has focused its compliance efforts on the specialized mobile radio service. Because this service was created in 1974 and operates on a for-profit basis, the Bureau believed licensees in this service should receive close oversight. Nevertheless, he told us in March 1988 that his Bureau was beginning to take steps to follow up with public safety licensees, particularly those with approved slow growth systems who had not filed the required regulatory reports.

Monitoring, On-Site Inspections, and Waiting Lists Not Used

FCC and APCO do not regularly monitor radio signals or make on-site inspections to obtain information on public safety use in the 800 MHz band. FCC's Field Operations Bureau conducted one monitoring study of 10 cities in 1985 and another of 1 city in 1986 in order to evaluate 800 MHz usage in the private land mobile service. FCC has not conducted any monitoring studies or on-site inspections in 1987 or 1988. Also, neither FCC nor APCO maintains a list of public safety agencies waiting to obtain frequencies in congested cities. Monitoring, inspections, and waiting lists are important management controls that could be used by FCC to

independently verify how licensees are actually using assigned frequencies and to document the amount and type of unmet demand. These controls could help FCC carry out its responsibilities for evaluating how efficiently public safety agencies are using their assigned frequencies.

Monitoring and Inspections

Monitoring studies measure the amount of time a radio channel is occupied with a signal. Monitoring studies are performed with a mobile van containing a computer-controlled scanning receiver capable of scanning frequencies in selected geographic areas and recording channel occupancy. Monitoring studies collect such data as the percentage of time a channel is occupied, the message length of transmissions, and the variance of occupancy throughout the day.

On-site inspections are conducted by FCC field personnel who visit the physical installation of licensed radio systems. On-site inspections can verify that the licensed radio system is in operation and in compliance with FCC's rules and regulations and the license's conditions. For example, an on-site inspection could include a check of radio equipment inventory records and a physical count of radios and vehicles reported as mobile units. FCC's Field Operations Bureau considers random, on-site inspections alone to be a costly method and prefers to select sites to visit using a systematic approach. For example, the Field Operations Bureau would prefer to rely on monitoring data to guide its selections of areas for on-site inspections. Monitoring data showing very light frequency use relative to the number of authorized mobile units might indicate the need for an on-site visit.

Our review found that FCC and APCO have not, in general, used monitoring and on-site inspections to obtain information on public safety's use of the 800 MHz band. Specifically,

- FCC does not regularly use monitoring to measure spectrum usage by private land mobile licensees, including public safety services, and
- FCC does not make on-site inspections of public safety 800 MHz radio systems except on an ad hoc basis, for example, in response to an interference complaint.

APCO's executive director told us that APCO is a volunteer organization that does not have the resources to monitor or inspect the radio operations of public safety licensees. As public safety's frequency coordinator, APCO's basic mission is to select discrete frequencies for applicants wanting to build or expand radio systems.

Monitoring radio signals has been a controversial method of obtaining data on frequency use. Although field staff have conducted several land mobile monitoring studies in the past, they have generated controversy over how the data should be interpreted. Opponents contend that monitoring can be a costly technique that produces inconclusive results. The FCC Chief Engineer explained that in the intense, competitive environment that surrounds FCC spectrum decisions, a monitoring study would have to be carefully done at a high level of precision to withstand the criticisms that would be expected from at least one of the parties contending for spectrum. Proponents of monitoring contend, however, that despite its limitations, it is the only way to obtain data on actual usage levels of land mobile frequencies. The Department of Commerce's National Telecommunications and Information Administration (NTIA) believes that monitoring is the only "real world" input available for making spectrum allocation decisions.⁴ It contends that well-engineered monitoring shows actual usage levels, which can be used to verify information contained in licensing files. According to officials from NTIA's Spectrum Engineering and Analysis Division, despite its difficulties, monitoring is the best way to measure frequency use. Monitoring is also suggested by FCC field staff as a way to verify the overall accuracy of license records and mobile loading counts reported by licensees to FCC.

FCC staff in both the Office of Engineering and Technology and the Private Radio Bureau pointed out to us that their resources are limited and that the radio spectrum allocated to public safety is only a small portion of the total spectrum FCC manages. They also emphasized that FCC can generally rely on public safety agencies to use licensed frequencies efficiently. Furthermore, public safety agencies, unlike most other radio services, must justify the need for radio frequencies with local government authorities in order to obtain the necessary funding. According to FCC staff, it is reasonable to assume that public safety agencies would not apply for radio frequencies if they did not need them and did not intend to fully use them.

Waiting Lists

FCC staff and APCO's executive director told us that in large cities like Baltimore/Washington, Chicago, Los Angeles, and New York, some public safety agencies want 800 MHz frequencies but cannot obtain them because none are available. However, neither FCC nor APCO maintains a formal waiting list of these public safety agencies. As a result, FCC does

⁴NTIA is responsible for management of the federal government's use of the radio frequency spectrum.

not have information on the type and amount of unmet public safety demand for 800 MHz frequencies.

FCC has established a formal process to control 800 MHz frequencies used by the specialized mobile radio service, which includes commercial firms providing radio communication services to others. Part of this process involves issuing a quarterly "waiting list" of applicants eligible for the specialized mobile radio service but unable to obtain frequencies. This list is useful for gauging the amount of unmet demand by applicants in this service and for identifying those firms who are next in line for frequencies that may become available. FCC has given special attention to this radio service because it is a relatively new service, created by FCC in 1974, and because the licensees in this service operate their radio systems to make a profit. FCC believes that new radio services need more oversight than mature services.

License Data and Informal Information Available on Public Safety Use

Although agreeing that regulatory reporting requirements, monitoring, site inspections, and formal waiting lists have not been used to obtain information on the amount of public safety frequency use, the heads of the Private Radio Bureau and the Office of Engineering and Technology pointed out that FCC's computerized license data base and informal, ad hoc sources (such as complaints and special studies filed with FCC) are sources of information on public safety use. For example, as an indicator of heavy public safety use, they cited data from the license data base showing that in the largest cities virtually all 800 MHz private land mobile channels have been licensed.

To evaluate the extent to which these informal sources provided information on existing public safety use, we reviewed

- the license data base, because FCC staff in both the Private Radio Bureau and the Office of Engineering and Technology stressed that it is the primary source of information available to FCC on licensees' use of the radio spectrum;
- complaints filed with FCC, because during the last few years the Private Radio Bureau has encouraged "self-policing" through which instances of regulatory violations and inefficient spectrum use are brought to FCC's attention by means of filed complaints from radio users; and
- selected studies, because they pertained to frequency use by private land mobile or public safety licensees.

Our review of license files, complaints, and special studies found that while they do provide some information on public safety use, they provide only minimal and conflicting measures of the amount of use public safety licensees are making of 800 MHz frequencies. The following sections discuss our review of this information.

License Data Base

As an indication of heavy public safety use of 800 MHz frequencies, FCC staff, APCO's executive director, and public safety officials pointed out that virtually all 800 MHz frequencies have been licensed in the largest cities. In response to our request, FCC staff provided us with information taken from FCC's license data base on the percentage of 800 MHz channels licensed in the 10 cities included in our review. These data showed that in New York, Chicago, Baltimore, Washington, Denver, and Miami, at least 99 percent of the 70 channels in the 800 MHz band dedicated to public safety in each of these cities have been licensed. The information also shows that in New York, Chicago, Baltimore, and Washington, at least 98 percent of all 600 channels allocated to land mobile services in each of these cities have been licensed. Consequently, public safety agencies and other private land mobile users in these cities wanting to expand or build new radio systems would have difficulty obtaining 800 MHz frequencies.

We found that FCC's license data base is helpful for obtaining information on the number and characteristics of radio users that have been authorized to use particular frequencies or for identifying what frequencies are licensed and not available for use. However, the license data base does not contain information on how the frequencies are actually being used. Rather, the license data base is essentially a computerized listing of information on the terms, conditions, and time periods under which FCC has authorized licensees to use radio frequencies.

FCC's Chief Engineer, one of its Commissioners, and NTIA have all noted that the license data base may not be an accurate reflection of actual frequency use. In a letter to GAO dated March 2, 1988, the FCC Chief Engineer wrote that although FCC's license file is the most complete and formal basis of FCC's knowledge of public safety radio licenses, it is widely understood that this source includes only the license information and not necessarily the actual usage. In a separate statement issued with FCC Second Memorandum Opinion and Order (Dockets 84-1231, 1233, and 1234, adopted September 17, 1987), an FCC Commissioner stated that the "data base may accurately account for the number of licenses and channels issued; however, it does not account for the

number of licenses and channels that are operating.” Finally, in comments dated June 5, 1987, submitted to FCC in connection with Docket 85-172, NTIA stated that license assignments may not necessarily reflect actual usage and licensing files may be incomplete or inaccurate.

Studies Raise Questions About License Data Base

In addition to these statements, we identified an FCC staff study and an APCO study that raised questions about whether FCC’s license data base could be used as an indicator of frequency use. In fiscal year 1985 FCC’s Field Operations Bureau (FOB) conducted an “Active/Inactive Licensee Survey” to determine what percentage of the stations in the private land mobile FCC data base were active stations. The survey was based on a random sample of all private land mobile licensees, which include public safety services. The survey found about one-third of the stations were inactive, that is, not operating. An FCC staff member suggested that many of those radio stations found not operating were business users who had gone out of business but had not returned their radio license to FCC. He expected that this situation would be corrected at license renewal time. Also, as discussed earlier, a radio user is given from 8 months to a year to place a licensed system in operation. Therefore, radio users recently granted licenses would not be expected to be operating. Nevertheless, the percentage of radio stations found to be inactive appears quite high.

In October 1987 APCO issued a study, Analysis of License Validation Survey Responses, prepared for the Federal Emergency Management Agency. APCO designed and executed the study to determine the relative accuracy of data contained in the FCC data base of licensed radio stations. The prime reason for the APCO study was that the Agency intended to utilize data contained in certain fields of the FCC license data base in a computer-based information system for federal response to emergencies. The data base would enable federal officials to determine how to connect federal radio systems with state and local radio systems for a specific area of the country.

Each license in the FCC data base consists of many fields, or data items, detailing the numerous technical and statistical aspects of each licensed radio system. For the purposes of the APCO study, 14 fields were tested. The fields included such data as the location, frequency, transmitter power, and units in operation. APCO sent a survey document to 1,000 randomly selected licensees asking whether the information from FCC’s data base was correct.

Based on 830 returns received, APCO's analysis found an average error per field of 9.37 percent. However, the average error per field was skewed by the 47.6 percent error rate in the units field, the greatest percentage of error found in the survey. APCO concluded overall that the Federal Emergency Management Agency should be "comfortable" though cautious with the data it uses that come from the FCC data base. APCO, however, also stated that the units field "simply doesn't possess enough accuracy for Federal personnel to confidently make judgments about a State or local agency's telecommunication capability." While not disputing the survey's findings, FCC staff from the Office of Engineering and Technology emphasized that APCO's study did not ask the licensee to supply any corrections to the data; the study asked only whether the information was correct. Consequently, the study did not determine the extent to which the units field was incorrect. Again, however, the findings of this study raise concerns about the accuracy of information in the license data base as an indicator of frequency use.

Few Complaints Filed Against Public Safety Agencies

According to the Chief of the Private Radio Bureau's Compliance Branch, only three complaints have been filed with FCC against public safety agencies since 1982, and all three cases involved radio frequencies that were not being used. After conducting an investigation, FCC notified the three public safety agencies that their licenses were cancelled. One case is currently under appeal. The Compliance Branch Chief explained there have been few complaints because previously the 800 MHz public safety spectrum was readily available; therefore, there was little incentive for someone to complain to FCC. However, since public safety spectrum is less available, particularly in urban areas, he expects FCC to begin receiving more complaints. He also explained that as spectrum availability becomes tighter, applicants unable to obtain frequencies will be looking for licensed frequencies that are not being used.

Studies of 800 MHz Frequency Use

FCC staff and other parties have conducted special studies to obtain radio spectrum data of interest to the FCC. We identified four studies that had been conducted since 1985 that contain some information relating to public safety use of the 800 MHz band.⁵ One of the studies was an FCC internal analysis to explain why two of the other studies had such widely differing findings.

⁵See appendix I for more information on the four studies.

We found that the studies had limited data that FCC could use in determining public safety use of the 800 MHz band because (1) three studies looked at all private land mobile use in the 800 MHz band in certain cities and had only limited data specifically on public safety use and (2) only the internal FCC analysis considered that public safety and other land mobile licensees have from 8 months to several years to load and place their radio systems in full operation.

Conclusions

FCC is responsible for ensuring that public safety agencies use their licensed frequencies efficiently. Although FCC has available to it various management controls that could assist it in fulfilling this responsibility, it has not regularly used them. First, FCC has not reviewed license files, as part of management oversight, to assure public safety licensees comply with regulatory reporting requirements. Second, it does not employ monitoring or site inspections to systematically collect data on actual public safety frequency use. Third, it does not maintain formal lists of public safety agencies waiting for frequencies. FCC officials believe that FCC can generally rely on government agencies to use licensed frequencies efficiently. We believe that FCC's responsibility to efficiently manage spectrum use requires it to be actively involved, not merely trusting in others to use spectrum efficiently. Without information on how frequencies are actually used and the amount of unmet demand, FCC has no assurance that the radio spectrum is being used efficiently.

FCC staff cite limited resources, other priorities, cost, and the difficulties of monitoring as reasons for not monitoring radio signals and making on-site inspections. However, we believe some minimum level of effort is needed on FCC's part to test public safety use of 800 MHz frequencies. The high level of precision that might be required for adversarial allocation proceedings are unnecessary for the management purpose of determining whether a level of use is reasonable. Limited use of monitoring and on-site inspections in the larger cities where few 800 MHz frequencies are available should provide enough information for FCC to determine whether public safety services are making adequate use of the 800 MHz band. Monitoring and site visits would also be helpful for evaluating whether FCC's mobile loading standards continue to closely approximate efficient public safety frequency use. Frequencies identified that are not being used by existing public safety licensees or that are being underutilized could then be used by other agencies waiting for frequencies.

Formal waiting lists for each city where public safety agencies need frequencies would serve to document the amount and type of unmet demand and serve as a guide for allocating and licensing future spectrum. Information on cities with the longest waiting lists would also aid FCC in selecting areas where monitoring and site inspections would provide the greatest benefits. Areas with no or short waiting lists would not require as much FCC oversight.

Recommendations

We recommend that the Chairman, Federal Communications Commission, more aggressively carry out its responsibility to see that public safety agencies are efficiently using their assigned frequencies. To this end, FCC should improve its management controls over its licensing process in the 800 MHz band by

- enforcing its requirement that public safety licensees report usage information,
- monitoring radio signals and conducting on-site inspections, on a test basis in the larger cities, to obtain and verify data on actual spectrum use by public safety agencies, and
- maintaining formal waiting lists in high-demand areas of public safety agencies that cannot obtain frequencies because none are available.

Summary of Four Studies of 800 MHz Frequency Use

FCC staff and other parties undertake special studies, from time to time, to address issues of interest to the Commission. We identified four studies, conducted from 1985 to 1987, which contain some information relating to public safety services' use of the 800 MHz band. The following sections summarize the major findings and limitations of the various studies as measures of public safety frequency use.

FCC 1985 Study

In 1985 FCC's Field Operations Bureau conducted a monitoring study to determine occupancy levels of 800 MHz land mobile channels and reported the study's results in a September 18, 1985, working paper. FOB's study, done on its own initiative, was intended to identify possible problem areas in 800 MHz use rather than to precisely measure frequency use of individual licensees. Monitoring studies measure the amount of time a radio channel is occupied with a signal (that is, is actually being used). The FOB study measured off-the-air signals of all 600 land mobile channels in the 800 MHz band in 10 cities.¹ On the basis of the study's results, FOB concluded that overall about 66 percent of the available spectrum surveyed was not being used. The percentage of channels unoccupied (meaning no occupancy was found at all) ranged from 25 percent to 90 percent for the individual cities. We noted that the study did not report separate percentages for public safety services. A follow-up study, conducted in one of the cities during 1986, found little change in occupancy.

The high percentage of land mobile channels that FOB found to be unoccupied generated controversy within FCC and among the various radio services when it was released because at the time FCC was considering allocating additional frequencies in certain large cities to the land mobile services. Those opposed to such a decision questioned allocating additional frequencies to land mobile services when currently licensed frequencies were apparently not being used.

Motorola, Inc.

In connection with FCC Docket 85-172, Motorola submitted comments responding to FOB's monitoring study. Motorola's comments, dated June 10, 1987, criticized what it considered to be weaknesses in FOB's monitoring. Motorola criticized, among other things, the locations where monitoring equipment was placed, the lack of monitoring during nights and weekends when public safety agencies can be very active, and failure to

¹Four of the cities (Chicago, Miami, New York, and Philadelphia) are the same ones included in our study.

consider the fact that many licensed radio systems did not have to be fully operational at the time of FOB's monitoring. These limitations, according to Motorola, resulted in understating spectrum usage. Motorola reported that it had conducted its own monitoring of the 800 MHz land mobile band, which it described as "limited," in Chicago, Los Angeles, and New York. Motorola's monitoring showed that most of the 600 land mobile channels were in use: about 90 percent for Chicago, 89 percent for Los Angeles, and 86 percent for New York.

Mobile Satellite Corporation Study

In its "Report on Public Safety Use of 800 MHz," dated July 7, 1986, prepared in connection with an FCC proceeding, the Mobile Satellite Corporation discussed the results of its telephone survey of public safety 800 MHz licensees in 10 cities. The licensees selected were those assigned to the 70 channels specifically set aside for public safety in the 800 MHz band.²

The survey found that of the 10 cities studied, only New York City was using all of its available 800 MHz channels. Other metropolitan areas, including those as large as Chicago, Philadelphia, and Denver, had channels that were not being used and for which the licensee had not been able to obtain funding. The survey also reported finding that many of the systems that have been built operate with fewer channels and fewer mobiles than they were originally licensed to use. Of 97 licensed radio systems included in its survey, Mobile Satellite found that 20 systems, or 21 percent, would not be constructed, had not yet obtained funding, or had had funding denied. Another 25 systems, or 26 percent, were found operating at levels classified by Mobile Satellite as moderately loaded or lightly loaded. Overall, the survey found that of approximately 50,000 mobile units authorized, only about 30,000 were in use or currently proposed. However, the survey's analysis did not consider the time allowed for public safety systems to become fully operational after being licensed.

Internal FCC Analysis Comparing FOB and Motorola Studies

In June 1987 an FCC engineer analyzed the FOB and Motorola studies to determine whether the widely differing findings could be explained. The engineer concluded that the major factor explaining the different monitoring results was the increase in the number of radio stations required to be operational between the time FOB monitored and the time Motorola

²FCC rules allow public safety agencies to apply for business or industrial frequencies in the 800 MHz band if no public safety frequencies are available.

monitored. Using summary statistics from the FCC license data base, the engineer found that when FOB monitored and found many unoccupied channels, only 53,300 of 105,000 land mobile radio stations licensed nationwide were required to be operational. On the other hand, when Motorola monitored and found almost no unoccupied channels, the number of licensed radio stations had increased to 169,000 while the number required to be operational had almost doubled to 97,300 stations.

Our review shows that most public safety agencies were not issued a license until after 1983. These licensed radio systems would not have been required to be operational for 8 months to several years after the license issue date. Specifically, we found that 84 percent of the 245 public safety radio systems in the 10 cities included in our study were first licensed after 1983. Also, of 25 slow growth systems in our review that had filed annual reports with FCC as of November 1987, 18 reported that their systems were not yet operational. Thus, our data also indicate an increase in the number of radio systems required to be operational between 1985 and 1987.

However, although FCC's internal analysis and our data on 10 cities indicate that many public safety agency radio systems licensed on 800 MHz frequencies would not have had to be operational until the last few years, they do not address Mobile Satellite's finding that 21 percent of licensed public safety radio systems would not be constructed, had not yet obtained funding, or had had funding denied. Determining the extent to which public safety agencies intend to construct 800 MHz radio systems and whether this is a serious problem requires a combination of management controls, including monitoring and periodic reports from licensees.

Request Letter From Representative Howard C. Nielson, House of Representatives

HOWARD C. NIELSON
3D DISTRICT, UTAH

COMMITTEE ON ENERGY AND COMMERCE
SUBCOMMITTEES:
ENERGY CONSERVATION AND POWER
HEALTH AND ENVIRONMENT
TELECOMMUNICATIONS, CONSUMER PROTECTION
AND FINANCE

COMMITTEE ON GOVERNMENT OPERATIONS
SUBCOMMITTEE:
EMPLOYMENT AND HOUSING
RANKING MINORITY MEMBER

COAL CAUCUS
COPPER CAUCUS
STEEL CAUCUS
MILITARY REFORM CAUCUS

REPUBLICAN POLICY COMMITTEE

Congress of the United States House of Representatives Washington, DC 20515

June 10, 1987

WASHINGTON OFFICE:
1229 LONGWORTH HOUSE OFFICE BUILDING
WASHINGTON, DC 20515
(202) 225-7751

DISTRICT OFFICE:
#105 FEDERAL BUILDING
88 WEST 100 NORTH
PROVO, UT 84601
(801) 377-1776

#2205 FEDERAL BUILDING
126 SOUTH STATE STREET
SALT LAKE CITY, UT 84138
(801) 624-6301

#2 EAST CENTER STREET #1
MOAB, UT 84632
(801) 259-7118

UTAH TOLL-FREE NUMBER
1-800-245-1426

Honorable Charles A. Bowsher
Comptroller General of the United States
General Accounting Office
441 G Street N.W.
Washington, D.C. 20548

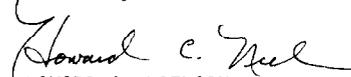
Dear Mr. Bowsher:

In the hearing conducted on October 1, 1986, by the Subcommittee on Telecommunications, Consumer Protection, and Finance of the Committee on Energy and Commerce, on spectrum usage, the Subcommittee began a review of auctions as a method of assigning frequency licenses. Efficient use of spectrum is essential if our country is to be able to benefit from new service offerings which are now, or are soon to be, available.

To ensure that current and future assignments of frequency for public safety are optimally efficient, I request that you study the existing use of spectrum for public safety purposes to develop information on two issues. First, I would like to know for what public purposes, safety or otherwise, these frequencies are used. Second, I would like to know the volume of public safety-related communications and other non-safety related communications on the 800 MHz spectrum currently assigned for public safety purposes.

I request a full study or an adequate sampling to assess the spectrum usage I have described. In order to properly assess this issue during this session, it is necessary to have the results of your study in sixty days. Minority staff of the Energy and Commerce Committee discussed this matter with your staff earlier this year, and some initial work has been done.

Sincerely,


HOWARD C. NIELSON
Member of Congress

Major Contributors to This Report

Resources,
Community, and
Economic
Development Division,
Washington, D.C.

Flora Milans, Associate Director, (202)275-8545
Ron Wood, Group Director
Lou Schuster, Evaluator-in-Charge
Robert Taub, Evaluator

Requests for copies of GAO reports should be sent to:

U.S. General Accounting Office
Post Office Box 6015
Gaithersburg, Maryland 20877

Telephone 202-275-6241

The first five copies of each report are free. Additional copies are \$2.00 each.

There is a 25% discount on orders for 100 or more copies mailed to a single address.

Orders must be prepaid by cash or by check or money order made out to the Superintendent of Documents.

United States
General Accounting Office
Washington, D.C. 20548

Official Business
Penalty for Private Use \$300

First-Class Mail
Postage & Fees Paid
GAO
Permit No. G100
